

REMARKS

Favorable reconsideration of this application is requested in view of the above amendments and in light of the following remarks and discussion.

Claims 1-7 are pending in the application. Claims 1, 2 and 4 are amended in a non-narrowing manner, including to remedy potential informalities, and new dependent claim 7 is added. Support for the changes to the claims is self-evident from the originally filed disclosure, including the original claims, and therefore no new matter is added.¹

In the Office Action claims 1-6 are rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,653,734 to Flanner et al. (Flanner). It is requested that the rejection of the claims be withdrawn, and that the claims be allowed, for the following reasons.

The present invention, as recited in independent claim 1, is directed to a plasma etching method, such as a method that can be used for manufacturing a semiconductor device. The semiconductor device can be made of a layer structure in which a resist film is formed as a mask on a silicon oxide film on a base silicon film. As recited in independent claim 1, plasma-processing is conducted under a process condition that is changed on the basis of a variation of a thickness reduction rate of a resist film.

Because the plasma-processing is conducted as described above, the thickness reduction of the resist film can be prevented or reduced. The rate is a differential value of the thickness with respect to time. Accordingly, in the claimed invention, the plasma-processing can be conducted according to a time-dependent variable.

In contrast, Flanner discloses a two-step etching process. As shown in

¹ New dependent claim 7 is supported, in part, from page 25, line 11 to page 27, line 2 of Applicants' originally filed specification.

Figure 9 of Flanner, a first etching step 904 is conducted when substantial amounts of photoresist are present on a surface of a wafer stack. A second etching step 908 is conducted after the endpoint of photoresist removal is detected. Accordingly, in Flanner, the etching process is conducted according to the thickness of the photoresist itself, without considering a time-dependent thickness reduction rate of the photoresist. Accordingly, the etching process disclosed in Flanner is different from the method of the present invention, and therefore it is submitted that Flanner does not disclose or render obvious the claimed features of plasma-processing being conducted while a process condition is changed on the basis of a variation of a thickness reduction rate of a resist film, as recited in independent claim 1.

For the above reasons it is requested that the rejection of independent claim 1 be withdrawn, and the allowance of independent claim 1 is requested.

Claims 2-7 are allowable for the same reasons as independent claim 1 from which they depend, as well as for their own features. The allowance of dependent claims 2-7 is therefore requested.

Notwithstanding the above discussion, which provides sufficient grounds for the allowance of the claims, it is submitted that the claims recite further features that are not disclosed or rendered obvious by the references of record, including Flanner.

With respect to claim 2, the claim recites that plasma-processing includes first and second processes. Further, in the second process, the plasma-processing is conducted under a changed condition in which selectivity against a resist film is higher than in the first process.

However, Flanner is completely silent on a selectivity difference in first and second processes.

With respect to claim 3, the claim recites that the above-described first process is

conducted by using a processing gas containing a CF-based gas, and that the above-described second process is conducted by using a processing gas containing a CHF-based gas. Accordingly, the processing gas used in the first process is different from the processing gas used in the second process.

Flanner discloses, in column 9, lines 20-25, that a passivant can be hydrocarbons or fluorocarbons. Flanner also discloses, in column 5, lines 30-35, that the hydrocarbons may further include hydrofluorocarbons. Flanner does not describe, however, that different processing gases, i.e., CF-based gas and CHF-based gas, are used in first and second processes, respectively.

With respect to claims 4 and 7, each of the claims recites that the second process is conducted by using a processing gas containing one or more components reduced when the first process is converted into the second process.

As the first process proceeds, an amount of by-product gas, e.g., CO gas, is decreased. The by-product gas is produced by the reaction between the process gas of the first process, e.g., CF-based, and the target layer, e.g., SiO₂. When amount of CO is reduced, it may be difficult to suppress the effect of O₂ in removing a reaction product acting as a protective layer of the resist film. Therefore, the reaction product is easily removed. Furthermore, because O₂ also acts to etch the resist film, the resist film is rapidly reduced.

Accordingly, as recited in claims 4 and 7, one or more reduced components, e.g., CO, are supplied in the processing gas of the second process to thereby prevent or ameliorate the thickness reduction of the resist film during the second process. It is submitted that the features are not disclosed or rendered obvious by Flanner.

Application Serial No.: 10/811,931
Reply to Office Action dated October 17, 2005

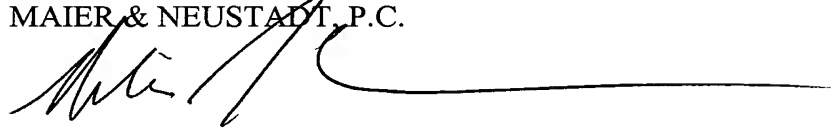
It is submitted that the above discussions provide alternate grounds for the allowance of the claims.

Consequently, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal Allowance. A Notice of Allowance is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact Applicant's undersigned representative at the below listed telephone number.

Respectfully Submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Steven P. Weihrouh
Registration No. 32,829
Attorney of Record

Philip J. Hoffmann
Registration No. 46,340

Customer Number

22850

Tel. (703) 413-3000
Fax. (703) 413-2220
(OSMMN 10/01)

SPW:PJH:brf
I:\atty\PH\25s\251167US2\251167US aml.doc